

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant OIL AND NATURAL GAS CORPORATION LIMITE et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ sent to the applicant and to the International Bureau a total of 6 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 19.07.2005	Date of completion of this report 01.09.2005
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 eprmu d Fax: +49 89 2399 - 4465	Authorized Officer Manolache, I Telephone No. +49 89 2399-2065 

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IN2004/000243

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

3, 6, 7	as originally filed
1, 2, 4, 5	filed with the demand

Claims, Numbers

1-7	filed with the demand
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Drawings, Sheets

1/5-5/5	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
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International application No.
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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 7

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 7 are so unclear that no meaningful opinion could be formed (*specify*):

see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos.

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

**INTERNATIONAL PRELIMINARY REPORT
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International application No.
PCT/IN2004/000243

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-6
	No: Claims	
Inventive step (IS)	Yes: Claims	1-6
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-6
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item III

In contrast with Rule 6.2(a) PCT claim 7 relies entirely on references to the drawings. As the claim has no technical features, the scope of the claim is not defined and for this reason this claim is not allowed.

Re Item V

Document D1: US 3 222 259 which is considered the most relevant state of the art discloses a liquid seal means comprising of:
a bent tube preferably of U shape with uneven arm length, and a liquid holder, one arm of the U tube being connected to the plant and the other arm connected to the liquid holder, said liquid holder having an opening at the upper portion above the level of the liquid.

The further features of claim I are new and the claim meets therefore the novelty requirement of Art. 33(2)PCT.

In the hydrocarbon plants, the gas presenting a safety hazard is collected from the entire area of the plant and burned. As this gas is very rich in hydrocarbon content, it is desirable that as much as possible of it to be recovered. However, while the gas at a relatively low pressure can be safely recovered, there is always a risk of the unexpected increase in pressure making the recovery process difficult and unsafe.

By the means of a non return valve placed in a conduit communicating between the lower portions of the liquid holder and the U-tube, the pressure in the pipe collector is continuously compared to the hydrostatic pressure of the column of liquid contained in the U-tube. When a higher pressure in the pipe collector occurs, the movement of the liquid from the U-tube in the liquid holder creates a free access way between the collector pipe and flare pipe, and consequently the

pressure in the pipe collector is maintained in safe range.

As the additional features of claim 1 solve the posed problem and these features are not suggested in any of the documents cited in the search report, it is considered that claim 1 satisfies the criterion set forth in Art. 33(3) PCT.

Re Item VII

The following formal matters are pointed out:

The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT.

No prior art is identified in disclosure as required by Rule 5.1(a)(ii).

The features of the claims are not provided with reference signs placed in parentheses to increase the intelligibility of the claims (Rule 6.2(b) PCT). This applies to both the preamble and characterizing portion.

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A LIQUID SEAL FOR RECOVERING FLARED GAS

(109)

Field of the invention

5 The present invention relates to the recovery of discharged gases and more particularly to provide a liquid seal means forming a device enabling safe recovery of maximum quantity of vented gas; often flared from oil production facilities, refineries, petrochemical plants and the like and thereby reducing the
10 quantity of gas flared to zero.

Background of the invention

In a hydrocarbon plant gas is vented from across the plant and this gas poses a
15 safety hazard. This gas is collected and is burned in a flare so as to reduce the risk of explosion as well as to ensure that uncombusted gas is not released in the atmosphere. There are available various processes by which this gas can be recovered, but not all the gas vented can be recovered as the quantity or the rate of vented gas is not constant. There is also a possibility of an upset in the
20 plant releasing large amount of gas, often exceeding the recovery capacity installed. Such extra volume of gas available in the confined pipeline increases the pressure of gas making the gas difficult to recover. To avoid the possibility of any mishap the available systems are designed in such a way that a permanent flare is maintained by burning the vented gas. The burning of the
25 vented gas involves substantial loss as this gas is very rich in hydrocarbon content and would have been otherwise recovered. Keeping a permanent flare also solves the problem of sudden and unexpected increase in the volume of vented gas as this gas will also be combusted in the flare.

30 While the gas at a relatively low pressure can be safely recovered, there is always a risk of the said unexpected increase in pressure making the recovery process difficult and unsafe. Another factor to be considered is to ensure that

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the recovery of gas does not cause a drop in the pressure of gas in the piping leading to the flare, as it can result in the ingress of atmospheric air into the flaring system creating an explosive mixture in the flare itself; endangering the
5 plant.

An important objective of the present invention is to provide a safe means to allow the recovery of gas, at the same time maintaining utmost safety, and also to prevent the ingress of atmospheric air in the flaring mechanism.

10

Another important object of the present invention is to provide a seal means capable of breaking instantaneously due to an increase in pressure beyond a predetermined limit, thereby allowing the gas to escape to the flaring mechanism unrestrictedly and being burned safely.

15

It is a further objective of the present invention to enable total recovery of vented gas thereby reducing the quantity of gas flared to zero during normal operation.

20 An other important object of the present invention is to provide a means allowing diversion of gas from one flaring system to another flaring system where plurality of flares are used and thereby enabling recovery of gas at a centralized facility.

25 **Summary of the invention**

The liquid seal according to the present invention consists of a U-tube having one arm connected to the plant and other arm connected to a liquid holder. The arm connected to the plant is preferably longer than the one connected to the liquid
30 holder. The shorter arm opens at the upper portion of the liquid holder above the liquid level and adjacent to or below the passageway connecting the liquid holder to the flare stack. A pipe fitted with a non-return valve connects to the bottom of U-tube to the bottom of the liquid holder. There is provided a drain pipe at the

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where there is one flare.

Figure **III** shows the liquid seal withstanding pressure.

Figure **IV** shows the liquid seal broken thereby allowing a free passage of gas to the flare stack.

Figure **V** shows the application of a liquid seal for recovery of vented gas where more than one flares are used.

Detailed description of the preferred embodiments

10

Although following examples shows the operation of specific embodiments, many modifications and variations will readily occur to those skilled in the art, accordingly it is not intended to limit the scope of the invention.

- 15 Accordingly with reference to the Figure **I**, the liquid seal comprises of a bent tube, preferably of U shape with arms of uneven length, such a U-tube having preferably longer arm **1** connected to the pipe **8** which is connected to the plant and shorter arm **2** connected to upper portion of the liquid holder **5** above the level of the liquid. A pipe **6** connected to the liquid holder **5** connects to the pipe
- 20 **9** forming a passageway which leads to the flare stack, the opening of U tube inside the liquid holder positioned adjacent to or below such passageway, while a piping **4** provided with a non-return valve **10** connects to the bottom of the U-tube. A drain pipe **3** fitted with a valve is provided at the bottom of the U-tube. The pipe leading to the flare is provided with a blind **11** to block the passage of
- 25 gas from the plant to the flare stack and also dividing the said pipe; forming pipe **8** and pipe **9**.

In another embodiment of the present invention there is provided a pipe **7** connecting the tip of arm **1** to pipe **6** to supply a limited quantity of gas to the

30 flare stack for equalization at the time of restarting the system after maintenance.

The liquid seal assembly can either forms a part of the pipe leading to the flare stack or can be attached to it as shown in the Figure **II** where it is installed between the knock out drum **13** and the flare stack **15**.

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With reference to Figure **II** a line **8A** collects all the gas vented from across the plant and connects to a knock out drum (KOD) **13**. A liquid seal **L1** is installed after the KOD **13** and a pipe **9** connects the liquid seal to the flare stack **15**. A
5 line **12** is provided originating between the KOD **13** and liquid seal **L1** extending to recovery system **14**.

During normal operation all the vented gas is collected by line **8A** and passed on to KOD **13**. Due to the presence of liquid seal **L1** and piping blind **11** between the
10 KOD **13** and flare stack **12** the passage of gas to the flare stack is blocked. The gas passes from the KOD **13** through line **12** to the recovery system **14** and effectively all vented gas is recovered. As no gas escapes from the plant to the flare stake there is no need to keep the flare burning.

15 When the liquid seal is in operation as shown in Figure **III** there is a pressure applied by the gas on the surface of liquid in arm **1** of the U-tube pushing the liquid in downwards direction. There is a corresponding rise in the level of liquid in arm **2**. The total length of tube is calculated according to the predetermined value of pressure to be handled as well as to ensure that even
20 the creation of vacuum pressure at the recovery process does not lift the liquid out of the liquid seal. In case of an upset in plant or if the volume of vented gas exceeds the recovery capacity installed, the pressure of gas rises in pipe **8**. When, due to a large increase in the volume of gas vented or an upset in the plant, the pressure on the surface of the liquid in arm **1** becomes more
25 than this predetermined value, then the total liquid in the U-tube becomes incapable of exerting a back pressure on the gas and as a result this column of liquid gets displaced completely into the liquid holder **5** breaking the seal instantaneously as shown in the Figure **IV**. This makes the U-tube empty of the liquid; giving a free passage to the gas to escape through the U-tube to
30 the liquid holder **5** and then through the pipe **6** to the pipe **9** and finally to the flare stack. The excess gas escapes from pipe **8** to the pipe **9** through the now broken liquid seal **L1** and finally to the flare stack **15**. In order to prevent the

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We claim:

1. A liquid seal means comprising of:

- 5 (a) a bent tube, preferably of U shape with uneven arm length, and a liquid holder, the longer arm of such U tube connected to the plant and the shorter arm connected to the liquid holder forming an opening at the upper portion of the liquid holder above the level of the liquid, such an opening of the shorter arm of the U tube inside the liquid holder positioned adjacent to or below the mouth of the passageway connecting the liquid holder to the flare stack;
- 10 (b) a pipe, fitted with a non-return valve, connecting the bottom of the liquid holder to the bottom of the U-tube;

15 the U-tube and the liquid holder forming a structure so as to form the only passage available for the gas to escape from the plant to the flare stack;

such gas escaping from the plant to the flare only when the liquid in the said U-tube has been completely displaced into the liquid holder due to the pressure applied by such escaping gas.

20

2. A liquid seal means as claimed in in claim 1 wherein the U-tube is provided with a drain, fitted with a valve, at the bottom of the said U-tube.

25 3. A liquid seal means as claimed in in claim 1 and 2 wherein there is provided a pipe connecting the tip of the longer arm of the U-tube to passageway connecting the liquid holder to the flare stack;

4. A device including the liquid seal means as claimed in any of the claims 1 to 3 comprising of:

30

- (a) a pipe means collecting all the gas vented from across the plant process carrying the said gas to knock out drum (KOD) means;

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(b) a liquid seal means and piping blind means installed between the said KOD means and a flare stack means;

(c) a pipe means originating from between the said KOD means and the said liquid seal means carrying the gas to a recovery system means;

(d) a pipe means collecting all the gas vented from across the second process and carrying such gas to a second KOD means;

(e) a second liquid seal means and piping blind means installed between the said second KOD means and a second flaring means;

(f) a second pipe means originating from between the said second KOD means and the second liquid seal means carrying the gas to the recovery means; such second pipe means provided with a restricted orifice to control the flow of gas from within it to the said recovery means.

5. A device as claimed in claim 4 wherein the said second liquid seal means is capable of withstanding higher pressure than the said first liquid seal means.

6. A device as claimed in claim 4 wherein there is a unitary gas recovery means for plurality of flaring systems.

7. A liquid seal means, constructed and arranged substantially as herein described, with reference to and as illustrated in the accompanying drawings.

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